Managing Climate Risk for Agriculture and Water Resources Development in South Africa

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Managing climate risk for agriculture and water resources development in South Africa

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Two Projects: 2003-2010

- Assessment of Impacts and Adaptation to Climate Change (AIACC) – GEF/UNEP
  - University of Cape Town
  - University of the Free State
  - Optimal Agricultural Business Systems (ZA)
  - URC
- Climate Change and Adaptation in Africa (CCAA) – IDRC/DFID
  - University of the Free State
  - University of KwaZulu-Natal
  - University of Cape Town
  - URC
  - IRI – Columbia University

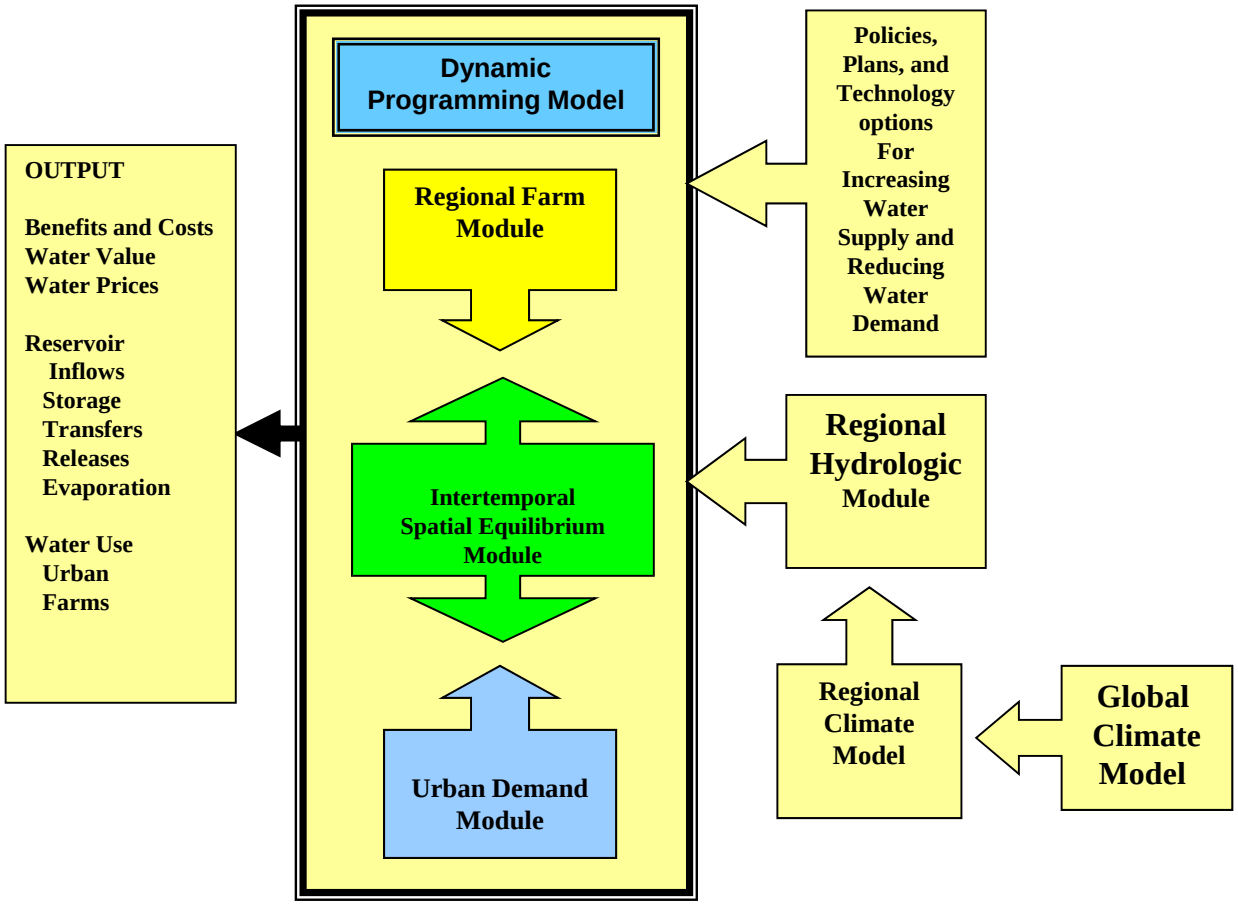
Motivation for the research

- A lot of people have focused on how vulnerable a country is to climate change, but not on the costs and benefits of adjusting to climate change (i.e., avoiding climate change damages)
- A “development” project can have a single objective, such as:
  - Coping with development pressure
  - Enhancing environmental quality
  - Creating more equality
  - Coping with existing climate variability
  - Coping with expected climate change
- But how the project is designed and how well it performs to meet these objectives will invariably affect the ability to achieve the others.
- So, we wanted to estimate the costs and benefits of some water resource development projects and examine how coping with development pressure and existing climate variability would affect the ability to adapt to climate change, achieve environmental quality and create more equality.

The AIACC project setting

- Development Pressure and climate coping problems in the Western Cape:
  - Urban water demand in Cape Town is increasing rapidly
  - Agricultural exports (fruit and wine) from the basin are vital to South Africa's economy
  - Global and regional climate models are predicting reduced runoff due to hotter, drier conditions
- We built an "integrated climate-water-economic assessment model" for the Berg R. and are now improving it for the Western Cape. It estimates
- Benefits and costs for development projects and policies, such as:
  - Additional water storage
  - Reducing system water losses
  - Marginal cost urban water pricing
  - Additional municipal and industrial water conservation
  - Water markets for allocating stored water
- Value of the economic losses due to climate change (climate change damages) for different regional climate scenarios
- The value of the climate change damages avoided (Net benefits of adaptation) by development projects and policies and adaptation measures
- The opportunity cost of meeting environmental quality objectives
- Expenditures of different income groups on water

Schematic Diagram of Dynamic Spatial Equilibrium Model for River Basin Planning



Climate Change and Climate Variability

- Existing GCM don’t represent inter annual climate variability very well
- We wanted to do a better job of this by explicitly incorporating inter-annual climate variability into the climate scenarios used in the analysis
- WHY?
- To find out how the explicit introduction of climate variability affected:
  - The economic value of climate change damages,
  - The benefits and costs of adapting to both CC and CV
  - Cost meeting other project objectives

What we have found out so far (AIACC Project)

- Adjustment to rapid water demand growth **OR** climate change would be relatively painless and project net benefits for either objective (alone) would be large.
- Adjustment to BOTH (the interaction effect) could cost a lot more; the net benefits may become smaller, and how you adjust is important
- **Increasing storage capacity**:
  - Cost of increasing reservoir yields rises rapidly as climate change becomes more adverse.
  - Substantial risk that the climate scenario used to plan reservoir capacity will not occur in the future, resulting in over-building or under-building of storage capacity, which reduces project net benefits.
- **Water markets and marginal cost pricing of urban water**:
  - These are true “no regrets” measures: they increase net benefits no matter what climate scenario occurs, and
  - They substantially reduce the negative interaction effect between increasing urban water demand and climate change = large reduction in climate change damages

Current and Future Work (CCAA Project)

- Enhance the capacity of Africans to develop and use models like this to design and implement better integrated development and climate policies
- Involve a large group of stakeholders to determine:
  - How to improve the model for their needs
  - How to better use and apply the model
- Add more river basins in the Western Cape
- Add more development projects consistent with DWAF plans
- Add more climate-related adaptation measures
- Improve the ability to characterize and simulate climate risk